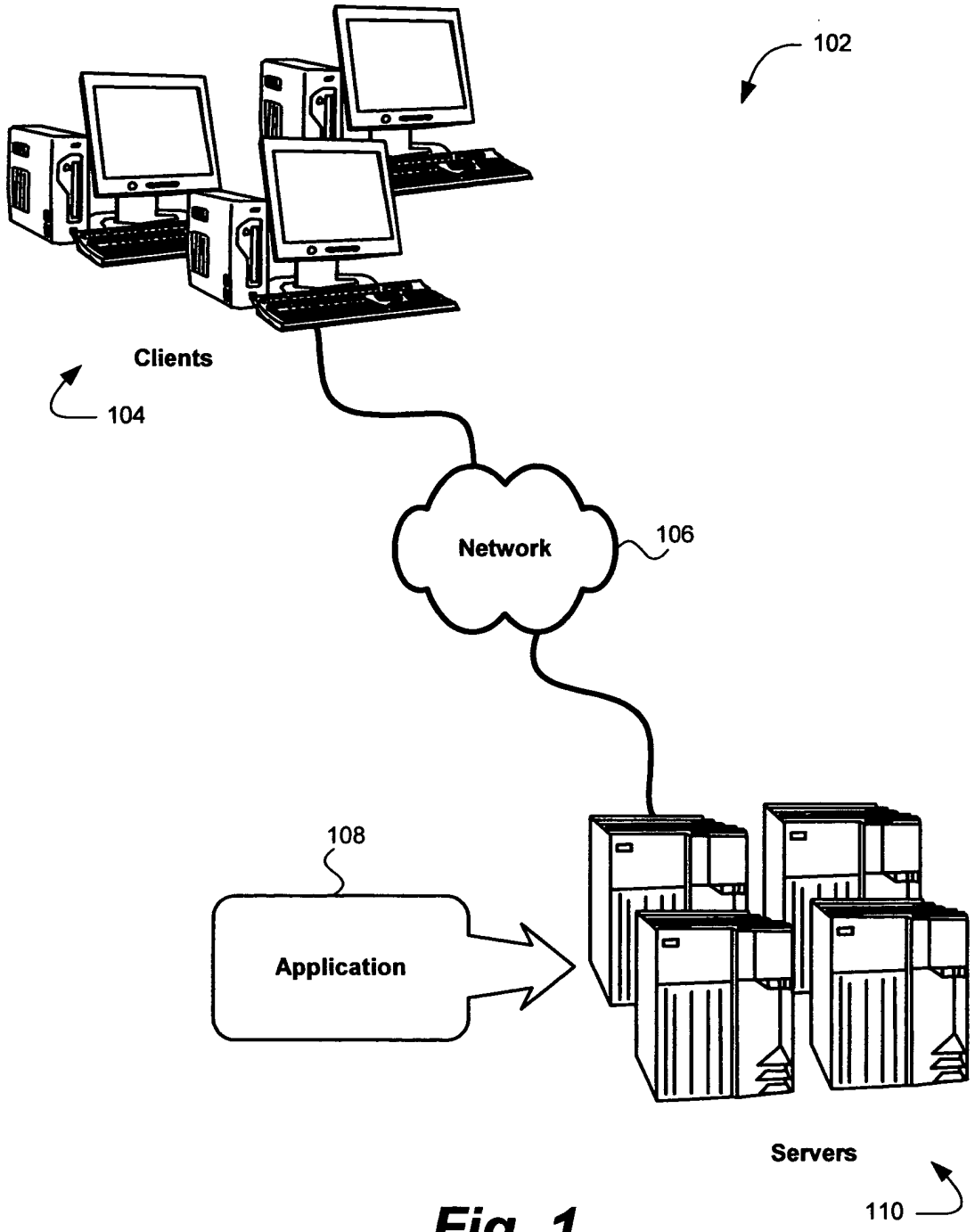

Fig. 1

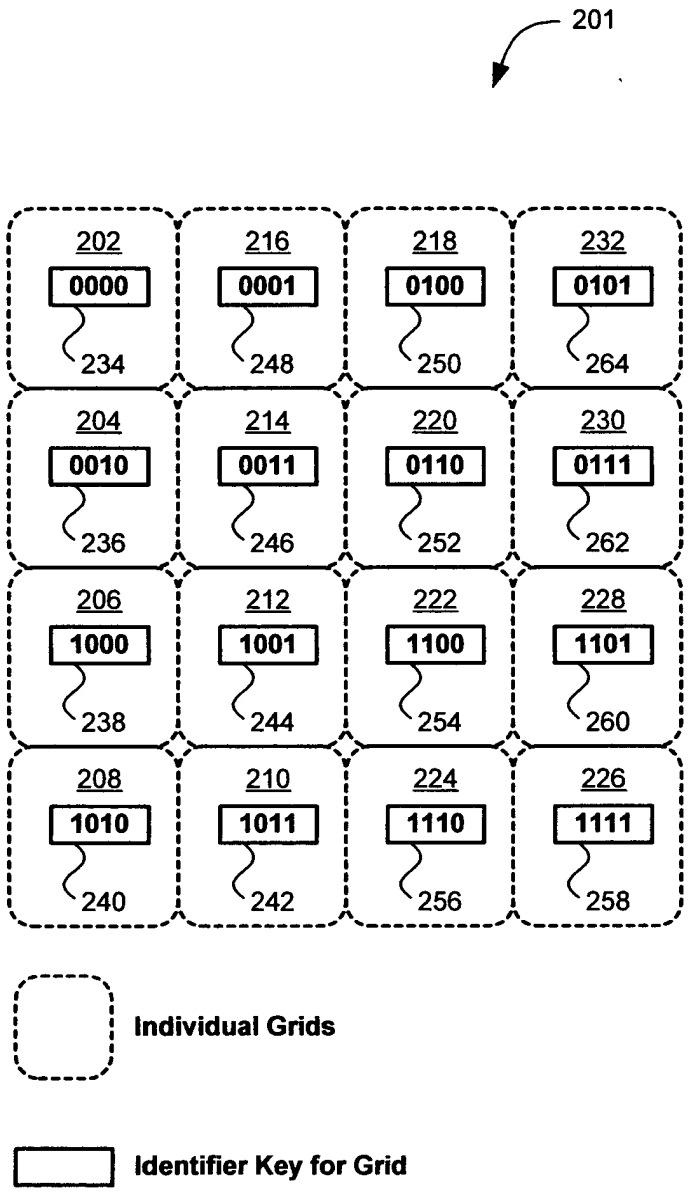
201
202
0000
234
216
0001
248
218
0100
250
232
0101
264
204
0010
236
214
0011
246
220
0110
252
230
0111
262
206
1000
238
212
1001
244
222
1100
254
228
1101
260
208
1010
240
210
1011
242
224
1110
256
226
1111
258
Individual Grids
Identifier Key for Grid

Fig. 2

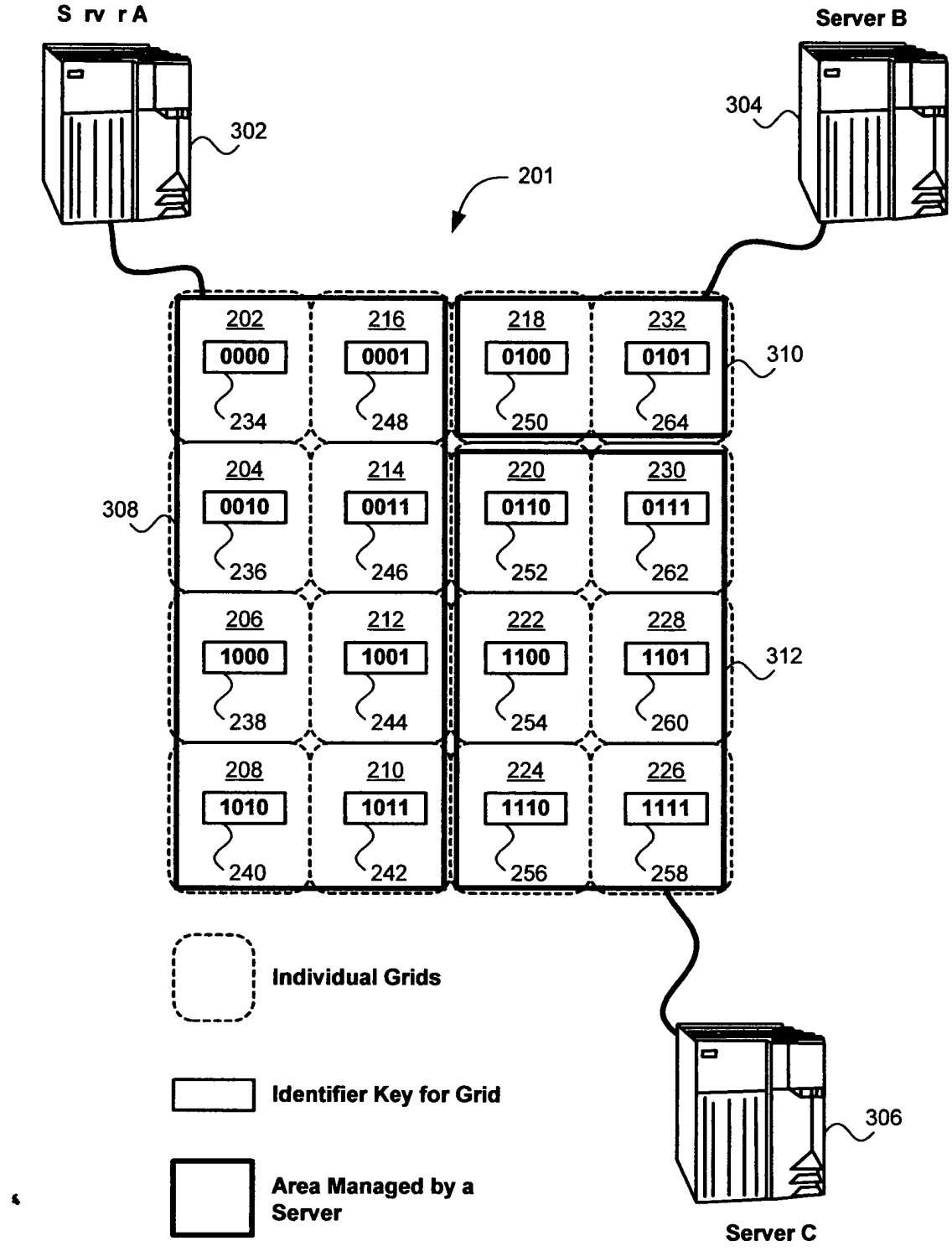
S rv r A
Server B
302
304
201
202
0000
234
216
0001
248
218
0100
250
232
0101
264
310
204
0010
236
214
0011
246
220
0110
252
230
0111
262
308
206
1000
238
212
1001
244
222
1100
254
228
1101
260
312
208
1010
240
210
1011
242
224
1110
256
226
1111
258
Individual Grids
Identifier Key for Grid
Area Managed by a Server
306
Server C

Fig. 3

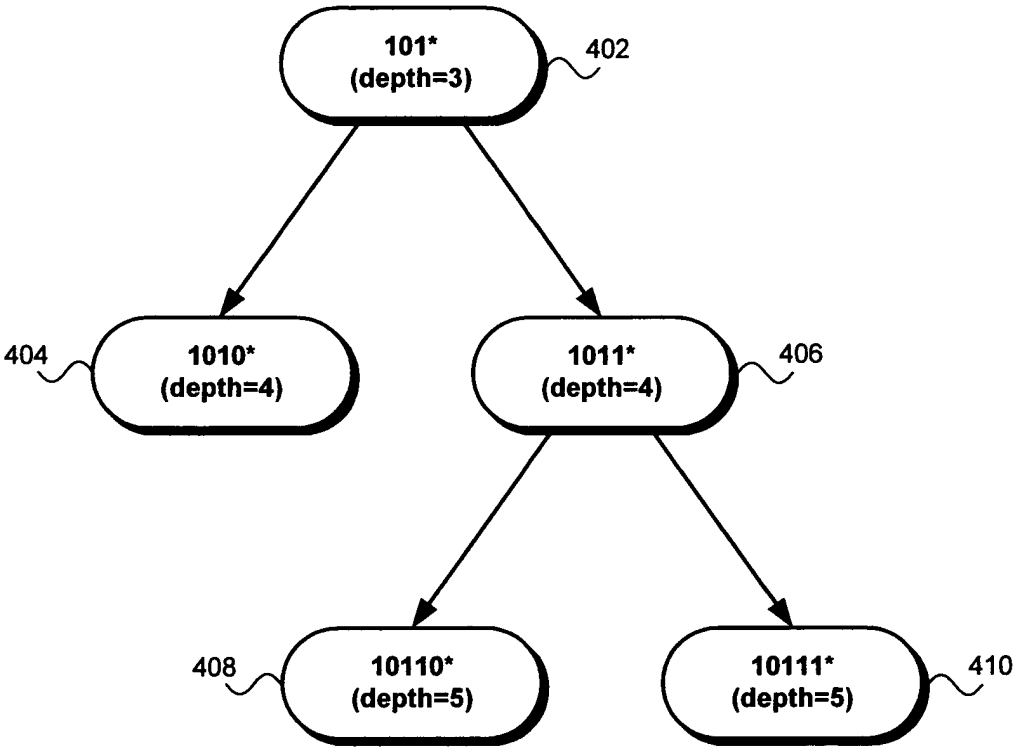
101*
(depth=3)
402
404
1010*
(depth=4)
1011*
(depth=4)
406
408
10110*
(depth=5)
10111*
(depth=5)
410

Fig. 4

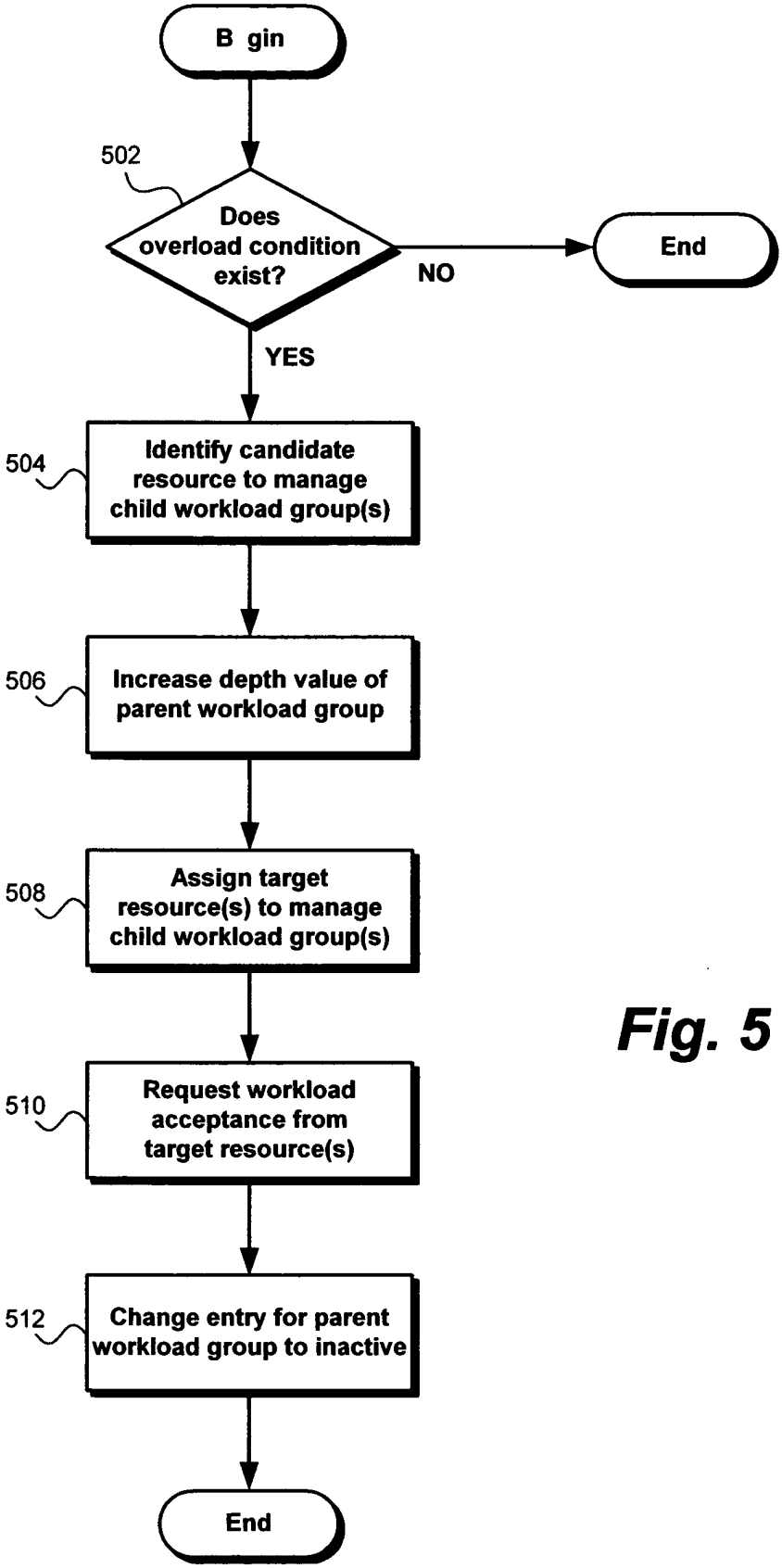
B gin
502
Does overload condition exist?
NO
End
YES
504
Identify candidate resource to manage child workload group(s)
506
Increase depth value of parent workload group
508
Assign target resource(s) to manage child workload group(s)
510
Request workload acceptance from target resource(s)
512
Change entry for parent workload group to inactive
End

Fig. 5

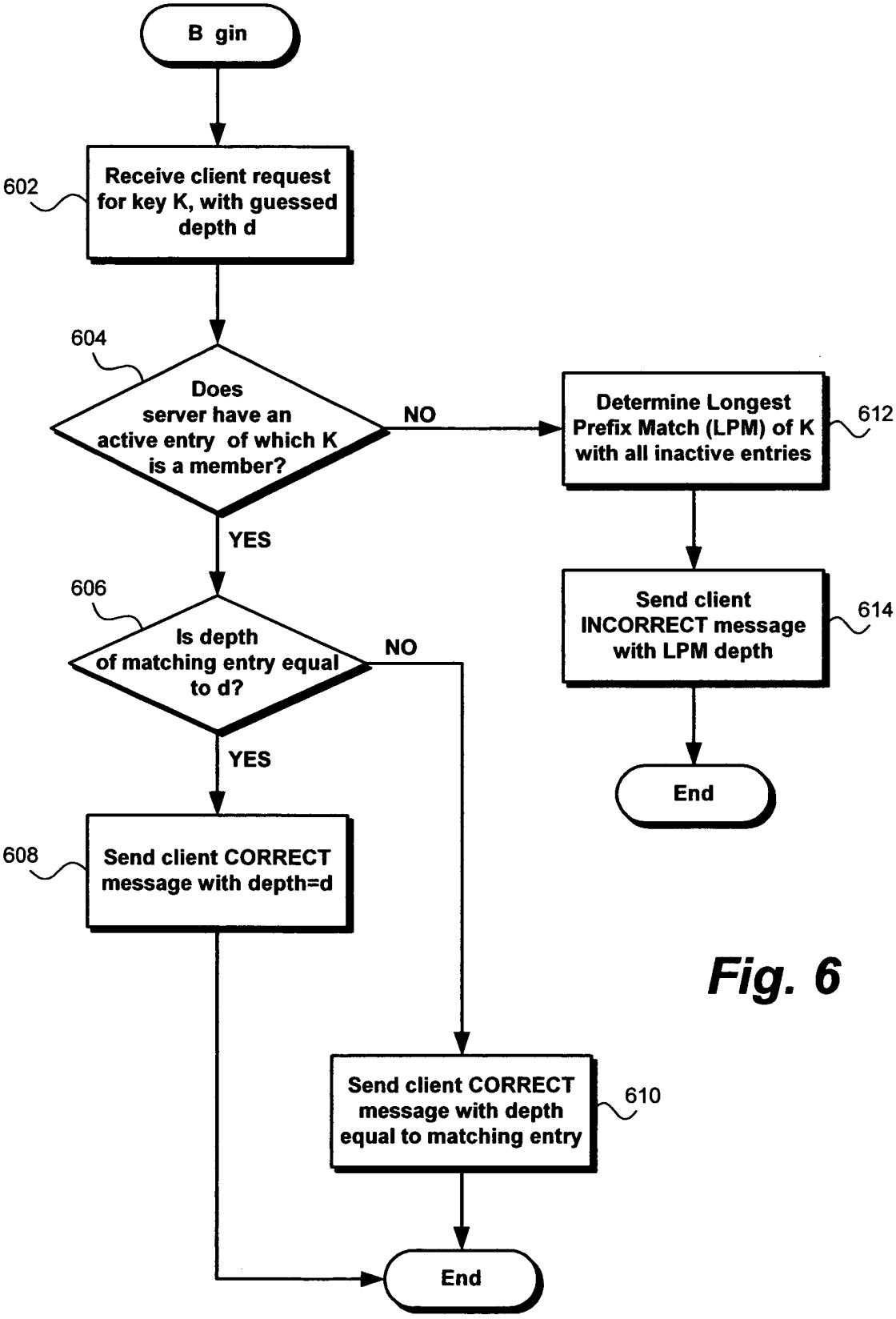
B gin
602
Receive client request for key K, with guessed depth d
604
Does server have an active entry of which K is a member?
NO
Determine Longest Prefix Match (LPM) of K with all inactive entries
612
YES
606
Is depth of matching entry equal to d?
NO
Send client INCORRECT message with LPM depth
614
End
YES
608
Send client CORRECT message with depth=d
Send client CORRECT message with depth equal to matching entry
610
End

Fig. 6

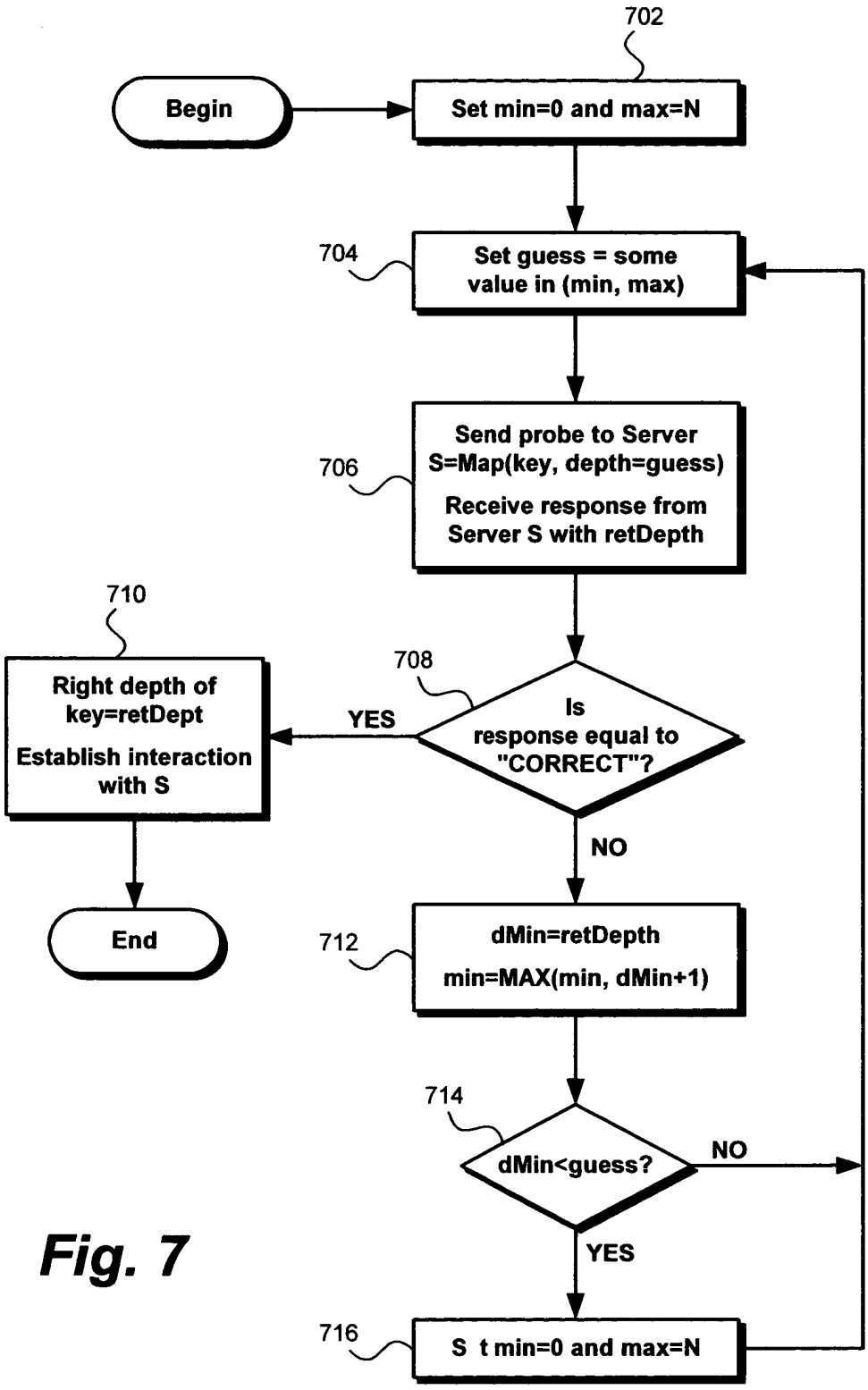
702
Begin
Set min=0 and max=N
704
Set guess = some value in (min, max)
706
Send probe to Server S=Map(key, depth=guess)
Receive response from Server S with retDepth
708
Is response equal to "CORRECT"?
YES
710
Right depth of key=retDept
Establish interaction with S
End
NO
712
dMin=retDepth
min=MAX(min, dMin+1)
714
dMin<guess?
NO
YES
716
S t min=0 and max=N

Fig. 7

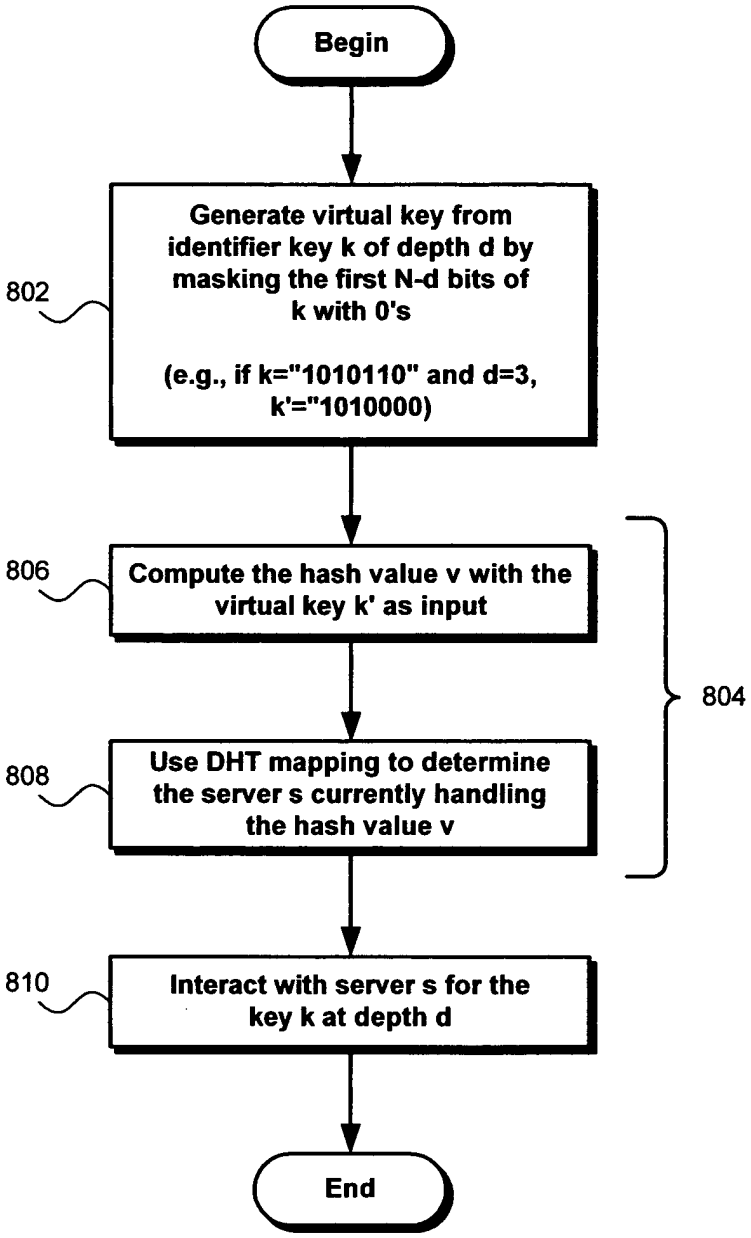
Begin
Generate virtual key from identifier key k of depth d by masking the first N-d bits of k with 0's
(e.g., if k="1010110" and d=3, k'="1010000)
802
Compute the hash value v with the virtual key k' as input
806
Use DHT mapping to determine the server s currently handling the hash value v
808
804
Interact with server s for the key k at depth d
810
End

Fig. 8

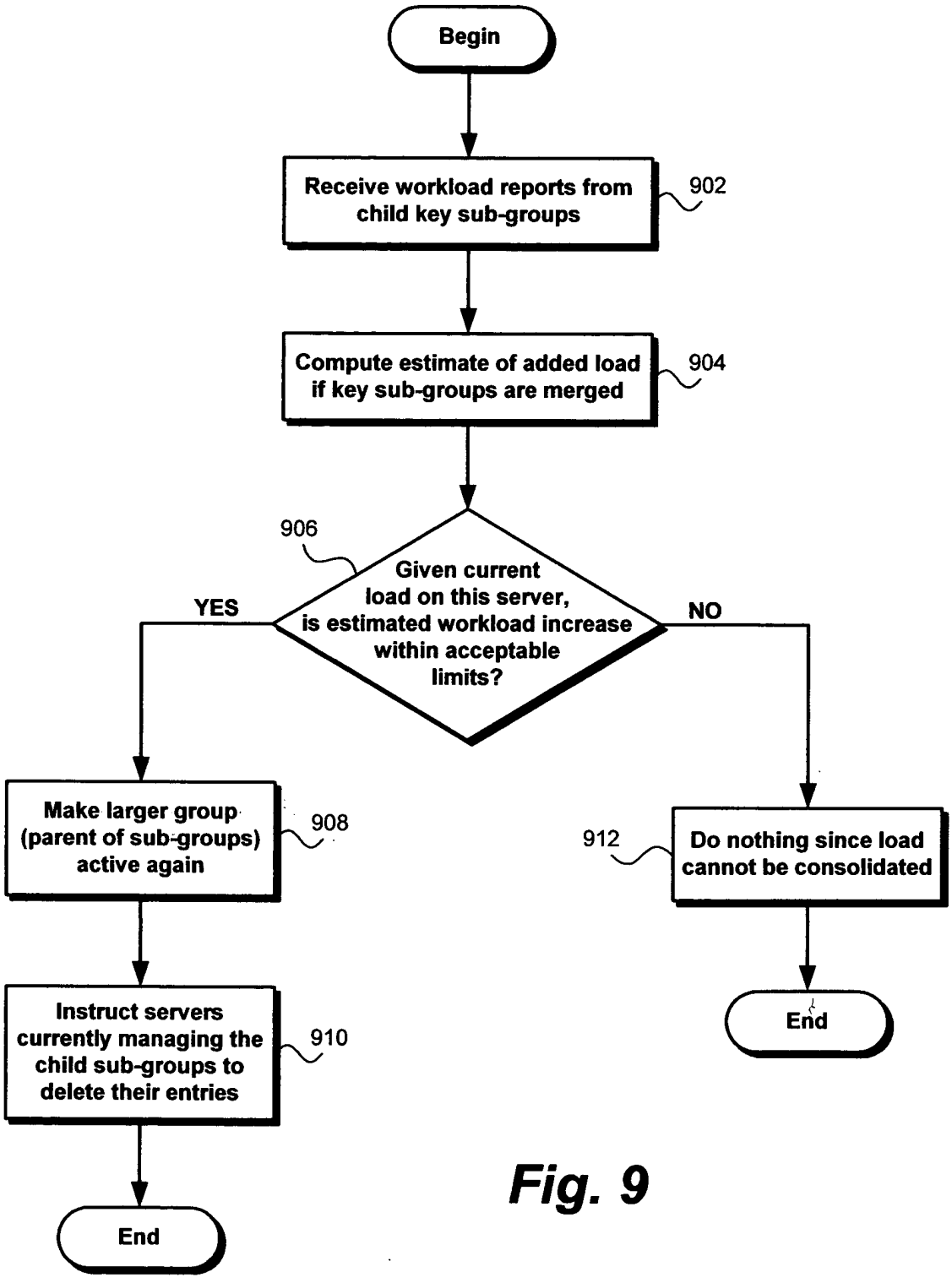
Begin
Receive workload reports from child key sub-groups
902
Compute estimate of added load if key sub-groups are merged
904
906
Given current load on this server, is estimated workload increase within acceptable limits?
YES
NO
Make larger group (parent of sub-groups) active again
908
Instruct servers currently managing the child sub-groups to delete their entries
910
End
912
Do nothing since load cannot be consolidated
End

Fig. 9